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3DWAYS INTERNATIONALIZATION PROJECT – IN-DEPTH ANALYSIS OF SWEDEN
SME COMPETITIVENESS FIELD LAB 2019/2020

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3DWays is a 3D printing service-providing company. Following a Country and Cluster Analysis, Sweden resulted to be one of the five most attractive countries in view of 3DWays' internationalization plan. Therefore, the aim of this section is to assess the following aspects, characterizing Swedish national business context: potential contacts, competitive landscape, market and sales potential and, finally, market entry conditions. After a careful analysis, it can be concluded that Sweden represents a favourable environment under every dimension, except for market and sales potential, which resulted to be extremely constrained due to its limited investments in AM industry and relatively narrow healthcare sector compared to other OECD countries.

3DWays, Internationalization, 3DPrinting, Competitiveness, Sweden

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3. IN-DEPTH MARKET ANALYSIS OF SWEDEN

I. Sweden
- Healthcare, Medical Technologies and Software & IT Sector Overview

II. Contacts
- Public and Private Healthcare Providers
- Research Institutes, Clusters and Universities in Healthcare and Medical Technologies
- Entrepreneurial Advisors

III. Competitive Analysis
- Additive Manufacturing Overview, Competitors' Segmentation and Positioning

In-depth Analysis of AM Competitors

IV. Market Potential
- Current and Future AM in Healthcare Market Size
- 3DWay's Projected Revenues (2020-2024)

V. Entry Conditions
- Trading and FDI Overview, Business Registration, IP Protection and Payment Systems
- Regulations on Trading Services, Cloud-Computing Services and Medical Devices

Sweden

Healthcare, Medical Technologies and Software & IT Sector Overview

HEALTHCARE SECTOR

- Sweden's healthcare system stands out for being one of the **most advanced in the world**, with the **third highest spending on healthcare**, equal to 11% of its GDP, compared to the EU average of 9.9%. (OECD, 2017)
- The Swedish **healthcare providers** sector grew by **4.1%** in **2018**, reaching a **total value of $60 billion** and displaying a **CAGR over the period 2014-2018** at **4.5%**. The **largest market segment** is represented by **long-term care** (29.2%), followed by outpatient care (28.8%). **Inpatient care**, which is the field in which **3DP** registers the **largest advancements**, accounts only for **18.9%** on the sector's total value. The **government represents the largest healthcare provider**, accounting for 83,8% market share, while **private distribution channels are considerably smaller**, accounting only for a further **16.2%** of the total sector's value. (Marketline, 2019)
- In Sweden, three are three main political and administrative bodies in control of the healthcare sector, resulting in a **highly decentralized system**: **central government**, **county councils** and **municipalities** (Export.gov, 2019). Different responsibilities are attributed to each of these public institutions. **21 county councils** are responsible for the overall supply of health and medical services and for the guarantee of satisfying health standards among the population. In particular, they are in charge of allocating the available resources among the different healthcare services, as well as planning medical services' offering for the upcoming years. On the contrary, **290 municipalities** currently manage nursing homes and are directly involved in the administration of the elderly and disabled categories. Furthermore, a total of **6 healthcare regions** have been set up across the country for more advanced care, coordinated by the Committee fro National Specialised Medical Care (Rikssjukvårdsnämnden) (Sweden.se, 2014) .
- With public healthcare playing a major role within the medical services supply, **public-private partnerships** are crucial for private businesses to penetrate the market. Although Sweden and the rest of Scandinavian countries characterize themselves for being early adopters of innovative technologies within healthcare, public procurement does not seem to be equally advanced. In fact, Sweden ranks as the **23rd nation** in terms of "**government procurement of advanced technologies**" in 2016 (Menon Business Economics, 2018), far below other European countries as Germany and France. In this sense, Swedish public institutions are not so competitive in fostering transformative healthcare solutions.

MEDICAL TECHNOLOGIES SECTOR

- Since 3DWays objective is to exploit the potential of 3D printers as medical equipment, as a result of its software installed in 3d printers directly used for therapeutic purposes (Johner Institute, 2019), it is important to highlight that Sweden ranks as the **fourth most attractive market in Western Europe for commercializing medical devices** (Norden, 2010), for which the Swedish market is expected to display a **constant moderate growth**, around 3% yearly (Export.gov, 2019).
- Studies conducted by the Swedish research institute Vinnova revealed how Sweden is characterized by **business strongholds** in **pharmaceutical**, **biotechnological** and **medical technologies industries**. In particular, Sweden ranks as 9th in terms of specialization exports for both pharmaceuticals and automation and tele-communication and 13th in terms of specialization exports for medical-technical equipment, in comparison with the other OECD countries. Within the health industry, Sweden registers the highest turnover in the manufacture of pharmaceutical preparations, while manufacture of medical and surgical equipment and orthopaedic appliances appears to be less profitable. (Norden, 2010)
- In Sweden, there are aproximately **629 companies** operating in the **medical technology sector**, for which a variety of sub-categories can be identified. In particular, t is possible to point out 279 medtech companies specialized in medical devices. Together with biotechnology, "**medical devices and supplies**" as well as "**medical equipment and related software**" are the segments in which companies receive the **highest number** of **investments** from both private and public funds. (Menon Business Economics, 2012)
- Some of the **internationally** known **Swedish medtech corporations** include **Getinge** (medical systems, extended care and infection control), **Molnlycke Healthcare** (single-use surgical and wound care), and **Elekta** (the Leksell Gamma Knife). Some of the major global companies characterized by a **strong presence in Sweden** include GE Healthcare, Baxter, Fresenius, Philips, Abbott, Thermo Fisher, Johnson & Johnson, Siemens, and Nobel Biocare. (Export.gov, 2019)

SOFTWARE & IT SECTOR

- With an overall **Scandinavian software market at $14.2 billion in 2018**, Sweden represents the **largest market** in the region, responsible for **35.8% of the total revenues**, reaching a value of $5.1 billion in 2018 and displaying a CAGR of 12.8%, in line with the overall Scandinavian growth rate. (Marketline, 2019)
- **Piracy is still a large issue in Scandinavian countries**, with **software piracy rate at 21%** and a total commercial value of unlicensed software around $260 million in Sweden. Copyright concerns are extremely significant for 3DWays, which has not been able to protect its self-developed software. (Marketline, 2019)
- The industry growth over the past years has been driven mainly by **mobile usage and cloud computing usage among businesses**. In particular, cloud computing allowed market players to switch from supplying software products to providing **Software as a Service** (Saas) **business model**, where customers pay a periodic fee for software, which is exactly what 3DWays is aiming at. (Marketline, 2019)
- In Scandinavia, **IT management** remains the **largest market segment** in the **software industry**, with total revenues of $4.8 billion, as a result of companies investing more and more in virtualization and new operating systems. (Marketline, 2019)
- **Acceleration** in **growth rates** for **Sweden**, expecting to reach a software market value of $10.9 billion by the end of 2023 with a CAGR of 16.3%, will be driven by the **increasing digitalization of Scandinavian companies**, which typically have a **forward-thinking attitude** in adopting new emerging technologies. (Marketline, 2019)
- However, within the **healthcare sector** and, especially, the medtech industry in Sweden, companies' value proposition is still **oriented** towards a **product-based offering**, especially when coming to serve sustainable and innovative hospitals where **physical products** dominate. **App** and **software** are the second following category, while **advisory services** still play a marginal role, with only 7% of the companies offering consulting services as their main product. (Menon Business Economics, 2018)

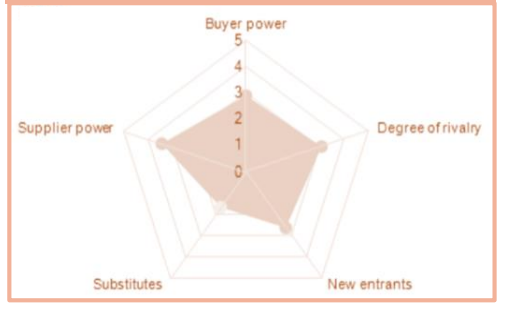
Sweden

Contacts: Public and Private Healthcare Providers

HEALTHCARE PROVIDERS

> Overall, the significant expenditure growth experienced by Swedish healthcare system contributed to decrease rivalry among players in the recent years. While intensively competing on **efficiency**, **quality of care** and **price**, **larger players** benefit from **scale economies** and, thus, are able to **negotiate** more intensively **on prices**. However suppliers, which must satisfy the **specific standards** set by regulatory authorities, can consequently negotiate a higher price. Suppliers' power is particularly strengthen by the fact that medicines and medical equipment are essential items for medical practices and healthcare providers significantly rely on their **quality** and **reliability**. In this sense, **good reputation** is crucial in this sector, representing a **entry barrier** for **new potential entrants**, such as 3DWays.

Forces driving competition in the healthcare providers sector in Sweden, 2018



Marketline, 2019

PRIVATE HEALTHCARE PROVIDERS

> The following **private leading companies**, providing healthcare services in Sweden and other Nordic countries, can represent **potential customers** and therefore contacts for 3DWays international expansion, together with public healthcare facilities (Marketline, 2019):

- **Aleris AB**, headquartered in Stockholm, provides the following offering in its healthcare centres: retirement homes, household services, home healthcare services, surgery, health assessments, radiology, foot surgery, emergency care, aviation medicine and others. It operates in **Sweden, Norway and Denmark**.
- **Ambea AB,** headquartered in Solna, offers both patient care and social care services for both mental and physical disabilities: diabetes care, paediatric, physiotherapy, plastic surgery, cardiac examination, occupational health care, somatic and dementia care, sports injury, refractive eye surgery, laboratory, imaging services and others. It operates in both **Sweden and Finland**.
- **Capio AB**, headquartered in Gothenburg, is a provider of medical, surgical and psychiatric healthcare services. Its offering includes orthopaedics, urology, gynaecology and neurology, heart and bariatric surgery treatment for lungs, eating disorders and physiotherapy, spine surgery, gastrointestinal surgery, treatment for ear-nose-throat disorders and vein surgery. It operates in **Sweden, Norway, Denmark, France, and Germany** thorough its network of specialist clinics, hospitals and primary care units.
- **Praktikertjanst AB**, headquartered in Stockholm, runs two different business activities: health care, with around 80 health centres, and dental care, with around 900 clinics and 50 laboratories. In particular, its health offering includes radiology, rehabilitation, obstetric and specialist medical care. It operates **only in Sweden.**

PUBLIC HEALTHCARE FACILITIES

> With an overall set of 85 public hospitals, Swedish **public sector** represents for 3DWays a **crucial intermediary**, with which the company will need to interact in order to win public contracts. Although public healthcare is recognized for not being at the forefront of technological advancements in Sweden, public hospitals and their municipal counties provide the **largest market potential** for 3DWays and **recent innovative programs** in **3DP technologies** have been made, as proved by the following **successful cases** implemented in public infrastructures:

1. **Ostersund Hospital**, within the orthopaedic department, in collaboration with Mid Sweden University and **Arcam AB**.
2. **Skane** and **Lund University Hospital** in collaboration with **Materialise** for customized implants.

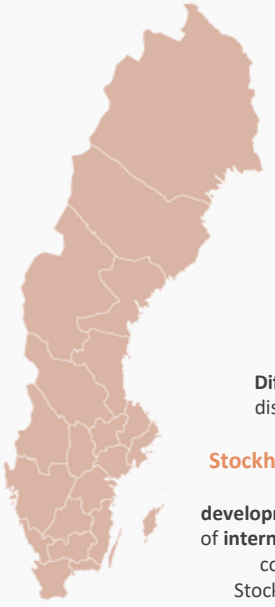
At the same time, it is relatively common for international players to encounter several difficulties while participating to public procurement procedures, which can be time and money consuming especially for SMEs as 3DWays. In fact, Sweden displays a **low rate of involvement** of professionals that are not coming from Sweden, **preferring national actors** as partners for **innovation projects** within the healthcare sector (Norden, 2010). In particular, **lack of flexibility in laws and regulations** as well as **contractual rules** are stated to be the **major external barrier** to PPP for innovation in Nordic countries' healthcare. The use of existing standards, especially in the case of innovative health products and solutions, often do not allow the implementation of technological advancements due to the difficulty to satisfy their related specifications, which would need to be re-negotiated and/or re-defined. A way for 3DWays to overcome the challenges characterizing public procurement is to **supply those companies** that are already **winning public procurements**, mainly those **manufacturing** and **distributing medical devices**. Companies operating in this sector can be seen not necessarily as competitors, but also as potential customers themselves. An example is provided by **GE Healthcare**, provider of medical technologies and services, which has recently opened a "**Design and Advanced Manufacturing Center for Europe**" in **Uppsala**, following the acquisition of **Swedish AM specialist Arcam** and **Concept Laser**. Therefore, potential contacts can be successfully established with the following companies, already responsible for supplying healthcare operators in Sweden, which have not invested yet in 3DP technologies and, thus, representing market opportunities for 3DWays:

MedGlobal, 2019

Sweden

Contacts: Research Institutes, Clusters and Universities in Healthcare and Medical Technologies

GEOGRAPHICAL DIFFERENTIATION



Different areas in Sweden distinguish themselves for different profiles:

Stockholm area: strong focus on **drug discovery** and **development** and concentration of **international pharmaceutical** companies. As part of the Stockholm region, Strangnas characterizes for some large bio-production plants.

Uppsala area: presence of **bio-tech tools** and **supplies companies**.

Gothenburg area: presence of **medical technology companies**, with AstraZeneca's largest research unit centre. Strong focus on the **development** of **oral cavity titanium implants**, **limb prostheses** and **bone-anchored hearing aids**. (Norden, 2010)

RESEARCH INSTITUTES

- **Vinnova** is a Swedish government agency that administers state funding for research and development, whose mission consists in promoting Sweden's innovation capacity and thus contributing to sustainable growth.
- **RISE** is an independent, state-owned research institute, operating in close collaboration with business community, academia as well as public sector in order to promote Sweden's competitiveness and innovation. In particular, they offer unique expertise in a wild range of sectors, including additive manufacturing, for which several projects have been implemented, such as "Connectivity and Health Monitoring of 3D-printed Components for Extreme Applications (CoHM3D)" funded in collaboration with Vinnova.
- **EIT Health Scandinavia** is responsible for a wide range of activities aimed at supporting promising start-ups and education programs designed to specifically drive further healthcare innovation. By having 18 partners including healthcare providers, industrial leaders and universities, EIT benefit from a unique collaborative environment based on stable connections with local start-ups and investor communities in all the medical-related sectors.
- **TADA Medical AB** is a Sweden-based joint venture between the KTH Royal Institute of Technology, Karolinska Institute and EIT Health whose vision consists of generating innovative-based solutions for the healthcare sector, as a result of world-class medical technologies.
- **HealthTech Nordic** accelerates start-ups growth and unite pioneers in the field of HealthTech.

INNOVATION & RESEARCH PROGRAMS

- **Medtech4Health** is a national strategic innovation program within Medtech Sweden.
- **Royal Institute of Technology Innovation** pre-incubator program is a yearlong program for early-stage, tech-based projects from KTH looking to speed up their development.
- The **Clinical Innovation Fellowship** teams operate in Europe's leading network for the systematic identification of clinical needs and development of solutions to impact healthcare worldwide. The program is a joint initiative of the Royal Institute of Technology (KTH), Karolinska Institutet (KI), and EIT Health, inspired by, and in cooperation with, Stanford University.

MEDTECH CLUSTERS

Within a total number of 11 med-tech clusters in Sweden, the two following clusters are the major ones:

- **Swedish Medtech** offers a wide range of medical technology firms, both manufacturers and distributors, going from orthodontic implants and stents to minimal invasive surgery products. In particular, among its 170 members, 82 companies operate within medical device while 36 focus mainly on e-health solutions.
- **Medicon Valley** is a leading international life-science cluster based in the Greater Copenhagen region, comprehending both eastern Denmark and Southern Sweden. In particular, 350 are the companies settled in the area, whose majority operate In the pharmacology, biotechnology, health technology and medical technology sectors. As a result of the collaboration with 9 universities and 28 hospitals, along with 10 incubators and 7 science parks, Medicon Valley is able to provide to the global business community opportunities for R&D and production within the cluster.

UNIVERSITIES

Although Swedish universities were one of the most advanced in AM research in late 90s, due to several factors, mainly related to scarcity of funds, the level of infrastructures became well below the European standards in the past years. However, the negative trend has recently been reversed, as a result of Sweden being able to attract the most prominent AM researchers. In particular, AM research programs are carried out in the following universities:

- **Blekinge University** (sustainability);
- **Chalmers University of Technology** (bio-printing and metal powder development);
- **Karolinska Institute** (bio-printing);
- **Lund University** (design and tooling);
- **Mid Sweden University** (medical applications and process development);
- **Stockholm University** (tailored microstructures);
- **Uppsala University** (process development);
- **Umeå University** (design);
- University West (process development);
- **Swerea** (material and production development);
- **SP** (characterisation and process development).

Vinnova, 2014

Sweden

Contacts: Entrepreneurial Advisors

Together with research and innovation institutes operating within the healthcare and medical technologies sector, 3DWays should also take advantage of the **entrepreneurial advisors** established in Sweden. In fact, their **business support might be crucial in accelerating the company's expansion plan**, especially due to its **seed stage** and the **highly regulated industry** into which it intends to internationalize.

ALMI

Owned by the Swedish government together with regional partners, Almi Invest provides funding and advisory services to those companies that want to expand. Benefiting from a wide geographical representation (50 offices across Sweden), their main targets are both business ideas with high growth potential in the early stages as well as new-born companies with highly innovative and scalable business ideas.

INTERNATIONAL ENTREPRENEUR ASSOCIATION

Administered by Almi, IFS offers cost-free services, available in different languages, as a guidance for those companies willing to start a business in Sweden. In particular, in addition to discuss business ideas and implement a business plans, IFS support enterprises to fill out forms for tax registration with the Swedish Tax Authorities and company registration with the Swedish Companies Registration Office, providing also information about permits and public authorities.

NYFORETAGAR CENTRUM

With offices all over Sweden, advisory services (business plan, budget preparation etc.) are provided by local enterprises with an extensive experience and knowledge, enabling foreign companies to get access to the local entrepreneurial network.

SWEDISH CHAMBER OF COMMERCE

30 foreign Chambers of Commerce are all based in Stockholm, supporting foreign companies to set up their business in Sweden.

BUSINESS REGIONS

They provide tailor-made solutions not only for companies aiming at establishing a business but also to those wanting to expand an existing business.

ENTERPRISE EUROPE NETOWORK

Represented by around 600 organizations in more than 50 countries, EEN offers free services, especially applied to small and medium enterprises, providing access to EU funding, understanding of EU legislation, international connections and commercial support.

Verksamt.se, 2019

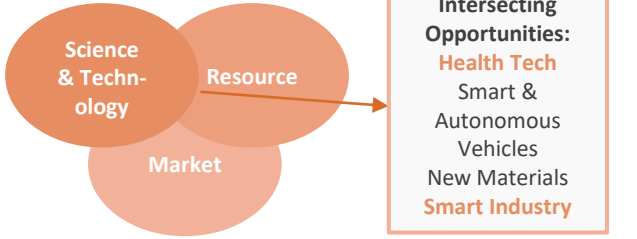
BUSINESS SWEDEN

Network of investment promotion partners

Owned by the Swedish government and the Swedish Foreign Trade Association, BS supports international enterprises that want to invest in Sweden by providing them the following services: presentation and matchmaking of investment opportunities, meeting arrangement, information related on how to start and run a business as well as access to Business Sweden's network, including both private and public companies/organizations. In addition to having access to the BS resources, capabilities and international network, businesses can also benefit from Business Sweden's logo.

Business Sweden targets leading companies in the following key fields:

- **Science & Technology driven**: ICT, Life Science, Tech scale-ups and VC. Examples: HCL Technologies;
- **Market driven**: Infrastructure & Construction, Retail; Examples: Uniqlo;
- **Resource driven**: Data Centres, Automotive & E-Mobility, Materials, Manufacturing; Examples: Amazon Web Services.



Herodes F., 2019

TRADING FOR START-UP

Strat-up, especially born global firms within the IT sector, whose sale occur often online, need special support in order to start the internationalization process since the very beginning. In fact, born global firms require personalized advices, different from the type of support provided to enterprises that have already built up domestic operations (Government Offices of Sweden, 2015). This can result to be extremely costly for small firms at their seed stages, such as 3DWays. In Sweden, the following advisors are specialized to accelerate the growth of start-up operating in highly technological industries, as 3DWays:

Start-up Sweden, through which other start-up as well as experts in the field provide practical advice and know-how in business development, not only to national companies, but also to foreign companies. Run by The Swedish Agency for Economic and Regional, it is free to participate to the program.

Swedish Cleantech, largest advisor for clean technology companies, getting access to knowledge, financing and networks.

Sweden

Competitive Analysis: Additive Manufacturing Overview, Competitors' Segmentation and Positioning

ADDITIVE MANUFACTURING

> In Sweden, the **current status of Additive Manufacturing is still not fully developed**, as can be shown by the **low adoption rates** compared to other European countries such as Germany, UK, France and Belgium (Kianian B. et al., 2016). The unexploited opportunities related to 3DP disruptive technologies will limit Swedish capabilities to innovate in a wide range of sectors, if no major investments will me made in the near future. However, **AM Swedish users** are starting to **acknowledge 3DP benefits**. In fact, based on Kianian B. et al. survey (2016), around 65% of respondents are extending 3DP capabilities beyond prototyping in order to implement a manufacturing process that can fully exploit 3DP technological applications. The **target market** for **3DP service providers** is mainly represented by **Small Enterprises** (1 to 15 employees), whose 58% stated to adopt and utilize 3DP technologies, compared to 20% of Medium and Large Enterprises. A reason behind it is the need for Small Enterprise to reduce the capital requirements necessary to reach economies of scale, enabling them to try their ideas at a lower entrepreneurial risk. As a result, SMEs can optimize their ability to innovate at a global level, where the demand for a lower time-to-market is increasingly spreading worldwide.

> In addition, **Swedish strengths related to AM** are the following: **materials** and **metal powders**, for which Sweden accounts for 30% of world production, **manufacturing** of **high-ends products**, **digitalization** and **automation**, **software** and **design**. Together with these areas of expertise, also the mind-set characterizing Swedish business environment is expecting to facilitate AM development, as a result of **early adoption** of new technologies, **innovation thinking** and **cooperation industry-institute-university**. (Swerea, 2018)

CURRENT COMPETITORS SEGMENTATION

Despite **two excellent manufacturers** of AM systems, Hoganas Digital Metal and Arcam, and **some well-equipped AM bureaus**, the **current status** of **Swedish 3DP** industry does **not** appear to be **highly advanced**, with a relatively limited competitive arena and with all major applications not going beyond prototyping (Swerea, 2018). Moreover, it is possible to identify the **following market segments**, taking into consideration **corporate size** and **sector expertise**. Although "large multinationals with cross-sectors expertise" might appear considerably distant from 3DWays, this segment can provide examples of **successful business realities**, from which best practices can be learnt and adopted.

LARGE MULTINATIONALS WITH CROSS-SECTORS OFFERING

Companies belonging to this category are 3DWays multinational competitors, whose operations are strictly connected to their Swedish home-market. Examples of these companies are ***SANDIVK*** and ***HOGANAS***, which are both characterized by a large number of employees (thousands) and revenues (billion). Due to their extension, both companies operate in a wide range of sectors and offer a large spectrum of products/services, among which addictive manufacturing is only one of them.

LARGE MULTINATIONALS WITH A MORE SPECIFIC SECTORIAL FOCUS

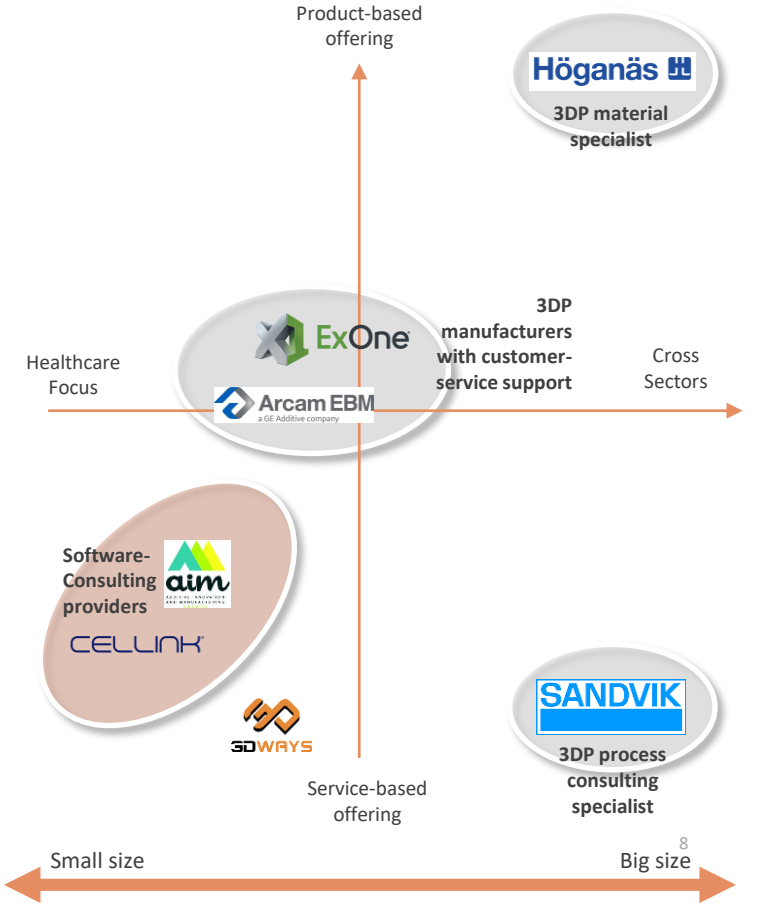
Companies belonging to this category are 3DWays large multinational competitors, with an extended geographical footprint but an explicit target on the healthcare segment. Examples of these companies are ***ARCAM AB*** and ***EXONE***, relatively large 3DP machines and products manufacturers, which have recently invested in the Swedish AM industry through the establishment of facilities and partnerships with local institutes.

SMALL AND MEDIUM ENTERPRISES WITH A STRONG FOCUS ON HEALTHCARE

Companies belonging to this category are 3DWays direct competitors, both in terms of sectorial focus (healthcare) and service-based offering (software/consulting). Examples of these companies are ***CELLINK*** and ***AIM***, which are small/medium national players. Their strength is represented by high specialization which lead them to distinguish themselves for high innovation capacity.

CURRENT COMPETITORS POSITIONING

With **3DWAYS positioning itself** as a **3DP service provider** for **healthcare**, the six selected market players, mentioned in the section before, can be grouped accordingly to their **offering type** (product/service) and **sector expertise** (cross/focus), generating the following classification: **3DP material specialist** (HOGANAS) **3DP manufacturers with customer-service support** (EXONE/ARCAM EBM), **software-consulting providers** (CELLINK/AIM) and, finally, **3DP process consulting specialist** (SANDVIK).



Sweden

Competitive Analysis: In-depth Analysis of AM Competitors

LARGE MULTINATIONALS WITH CROSS-SECTORS OFFERING

Headquarter: Stockholm, Sweden
Employees: 42,000
Revenues (2018): $11.4 billion (Orbis)
Offering: Sandvik has well-established expertise across the entire additive manufacturing value chain. Three service categories: specialist advice, manufacturing services as well as powder supplies. Concerning the advisory services: select what to print, material selection, design and modelling, choice of AM technology, selection of parameters for additive manufacturing, post processing and testing and quality assurance.
Geographies & Sectors: global (more than 130 countries), in sectors as aerospace, automotive, construction, oil & gas, mining, nuclear power and renewable energy (not explicitly healthcare).

Headquarter: Hoganas, Sweden
Employees: 2,402
Revenues (2018): $1.16 billion, with the HOGANAS SWEDEN 490 million (Orbis)
Offering: Hoganas produces and distributes iron and metal powders.
Geography & **Sectors**: global (more than 75 countries), with 18 production centres and sales offices or operations units in 17 countries. Customers come from a wide range of sectors such as automotive, energy, construction etc.
Healthcare: applications of additive manufacturing for medical implants.

Large financial and operative resources
Well-diversified product/service portfolio
Strong presence in Swedish market
Economies of scale
High brand reputation

LARGE MULTINATIONALS WITH A MORE SPECIFIC SECTORIAL FOCUS

News: Swedish AM specialist, recently acquired by GE Healthcare, chose the city of Uppsala in Sweden to open up its first Innovative "**Design and Advanced Manufacturing Center for Europe**".
Headquarter: Molndal, Sweden
Employees: 441
Offering: Arcam offers a quite comprehensive offering, including 3DP machines, auxiliary equipment, software services and training. The patent portfolio consists of 200 patents, which belong to 56 different registered patent families. Arcam's service agreements include the following treatments: spare parts, updates, 24/7 phone/mail support, preventive maintenance actions as well as emergency support. Along with service engineers, Arcam provides a team of "application support specialists", responsible for optimizing the EBM process settings accordingly to customers' specific production applications.
Geography & Sectors: global, with customers mainly in the orthopaedic implant and aerospace industries.
Healthcare: EBM technologies are used for production of both standard and customized orthopaedic implants. An increasing number of CE-certified and FDA-cleared implants have been produced with Arcam EBM technologies and supplied on the market.

News: Exone opened a new production centre in Sweden as a site of collaboration with the **Swedish Research Institute for Industrial Renewal and Sustainable Growth** (Swerea).
Headquarter: USA
Employees: 257
Revenues: $64.6 million (Orbis)
Offering: 3D printers manufacturing, with customer service and support such as review of manufacturing process, binder types and molding media, having also access to EXONE specialists pool providing personalized guidance and answers.
Geographies & **Sector**: global (in more than 250 countries), with a wide range of sectors including medical and dental.
Healthcare: Exone main projects go from printing metal molds for dental tooling to printing new prosthetics and other non-invasive medical devices.

Large financial and operative resources
Clearer value proposition on healthcare segment
New significant investments in Sweden
Economies of scale

SMALL AND MEDIUM ENTERPRISES WITH A STRONG FOCUS ON HEALTH

Headquarter: Gothenburg, Sweden
Employees: 190
Revenues (2018): $5.56 million (Orbis)
Offering: Cellink researches and develops bio-printing technologies that allow to replicate organs and tissues. It does not only supply hardware components but also could technologies, having a software portfolio which includes: HearOS operating system, simplifying the workflow through a user-friendly interface, DNA Studio desktop application, used to create print protocols and complex configurations, and DNA Cloud web portal, the latest software updates allowing to store all the printing protocols on the DNA Cloud.
Geography & **Sectors**: global (more than 50 countries), mainly in the pharmaceutical and cosmetic sectors.

Headquarter: Froson, Sweden
Employees: 10
Offering: AIM offers consulting services, going from the design and material selection to the 3D-printing manufacturing process itself, by not only using the available software but also developing best practices in combining them to maximize the design tools potential.
Geography & **Sector**: mainly in the industrial and medical sectors.
Healthcare: manufacturing of medical implants in titanium and plastic, as well as, surgical guides and pre-operative bone models in plastic.

Highly innovative technologies
High recognition in healthcare industry
Strong academic partnerships
Software as a service-based offering

In view of its internationalization, 3DWays aims at achieving a **similar positioning** to the one characterizing **small** and **medium enterprises** with a **strong focus on health**, both in terms of size (employees and geographies) as well as industrial focus (mainly healthcare). In fact, due to 3DWays limited resources, the company should pursue a **highly differentiated strategy**, having a **clear target** to which refer its own value proposition, as **CELLINK** and **AIM**. In particular, CELLINK benefits from a strong sense of community, built over time through publications, partnership conferences and ambassadors programs, which are crucial for companies operating in the medical technologies industry to acquire recognition and trust among customers and investors at early stages. However, as displayed by the positioning map in the previous slide, the **service-based solution** offered by **SANDVIK** can serve as a role model for 3DWays and thus a valid alternative to 3DWays turn-key solution. Big companies are recognizing more and more the **importance** of **not only suppling machines and materials** but also of introducing **AM advisory services** that enable clients to produce in a more cost efficient way. In this case, big corporations can benefit from a large amount of resources that can be invested in copying competitors' innovative practices, such as 3DWays software and its remote-control management service, which can be easily implemented by these large multinational competitors. On the other hand, 3DWays can defend itself through the **value network business model**, that once achieved and scaled, it will be hard for other competitors to copy, due to the time constraints and organizational transformations required for its implementation. In fact, if 3DWays manages to build the network before its competitors, a mechanism of **value network effects** can be established, favouring 3DWays which would benefit from a **first mover advantage**.

Sweden

Market Potential: Current and Future AM in Healthcare Market Size

CURRENT MARKET SIZE

> Due to the fact that it was not possible to find an already predefined value for the current market size of 3DP in the healthcare sector in Sweden, an estimation is needed. Starting with the total number of both public (85) and private (15) hospitals, the **market size for medical equipment in Sweden was approximately $2.4 billion in 2018** (Export.gov). The industry of medical equipment is the one that appears to be the more appropriate to our specific case, since 3D printers would be applied as medical equipment in healthcare infrastructures. In order to capture the value that is specific to the market segment for which 3DP would provide the highest added value, represented by surgical and orthopaedic medical applications, the turnover for "**manufacture of medical and surgical equipment and orthopaedic appliances**" (**17.33%**) (Norden, 2014) - in terms of percentage on the total amount of turnover in the healthcare industry - has been taken as a proxy and applied to the market size for medical equipment. The resulting outcome consists of the **market size for medical and surgical equipment and orthopaedic appliances (2018)** = 0.1733* $2.4 billion = **$416 million**. However, we are aware of the fact that 3DP technologies, which are still at an emerging stage, will not absorb all the potential market size related to the surgical equipment and orthopaedic appliances. Therefore, by applying the percentage of **industrial AM systems installed** in Swede, which was approximately 1.2% compared to the other countries in 2014 (Vinnova, 2014), the **total market size of AM** in **medical** and **surgical equipment** and **orthopaedic appliances** in 2918 can be calculated as it follows: 0.013061 *$416 million = **$5.43 million.**

> In order to **validate** the **result obtained from the analysis above**, which has been performed with some approximations due to the different timeframes of the data retrieved, an **analogy method** was performed by comparing 3DP development in Sweden **with the current status of 3DP in healthcare in Germany**. In particular, we have considered the number of hospital placed in both nations, 100 in Sweden and 2000 in Germany. Considering **Germany's 3DP market size in healthcare** equal to **$79.19 million** in **2016** (Statista, 2016), **Sweden 3DP market size in healthcare** can be retrieved as the following: $79,19*100/2000 = **$3.95 million**.

> With a **global market size for 3DP** in the **healthcare** sector estimated to be **$935 million** in **2018** (Statista, 2018), Sweden accounts for only **0.58% of the global market size ($5.43/935)**, which compared to other European countries such as Germany (8.47%), France (5.92%) and Italy (5.16%) appears to be still quite limited.

FUTURE PROJECTIONS OF MARKET SIZE - ASSUMPTIONS

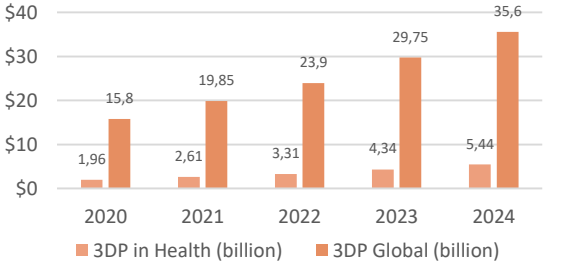
> In order to **project the market size** of AM in medical and surgical equipment and orthopaedic appliances in Sweden for the **next 5 years** (from 2020 to 2024), the **following assumptions** have been included in the analysis:

1. Knowing that the expected % of 3DP in healthcare on the global 3DP market size was 11% in 2018 (Statista, 2017), while it is expecting to become approximately 16% by 2025, it is assumed that it will growth at a constant growth rate every year, equal to 0.0071.
2. Knowing that the % of AM installed in Sweden in 2014 was around 1.2% (Vinnova, 2014), it is assumed the value will increase every year at a constant growth rate of 0,0214, which has been estimated by using as approximation the growing national interest in 3DP retrieved by Google Trends in the last five years.
3. While it is expected that the market size for medical equipment in Sweden is expected to grow with a CAGR equal to 3% (Export.gov), it is assumed that the % of turnover generated by the market segment expressed as "manufacture of medical and surgical equipment and orthopaedic appliances" will remain constant over the timeframe and, thus, at 17.33%.

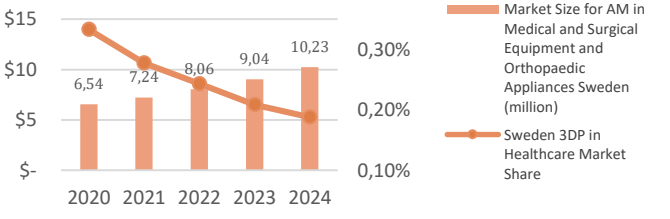
	Industrial AM systems installed (%)
2014	1,2000%
2015	1,2257%
2016	1,2519%
2017	1,2787%
2018	1,3061%
2019	1,3340%
2020	1,3626%
2021	1,3917%
2022	1,4215%
2023	1,4519%
2024	1,4830%

FUTURE PROJECTIONS OF MARKET SIZE – SWEDEN VS GLOBAL

Market Size of global 3DP industry and its application to the healthcare sector (billion)



Market Size for AM in Medical and Surgical Equipment and Orthopaedic Appliances Sweden (Million & as % of global 3DP in healthcare)



While the **overall industry, namely 3DP applications within the healthcare sector, is expected to reach by 2024 the total value of $5.44 billion, Sweden is not expected to grow as fast as the global 3DP market size**. In fact, the current **Swedish market share in 3DP for healthcare**, equal to 0.58% in 2018, **is expected to drop down to 0.19% by 2024**, showing as the **3DP market in Sweden will not benefit from the same advancements as the rest of the globe**. Despite of the positive increase in the **market size of AM in medical and surgical equipment and orthopaedic appliance**, reaching approximately **$10.23 million**, Sweden does not appear to be as attractive as other foreign countries, expecting to lose its current positioning, which is already recognized for not being at the forefront. This is also caused by the size of the healthcare sector in Sweden, whose total value in 2018 was of $60.1B, and thus relatively contained compared to other European countries such as Germany or UK, as a result of lower population density and lower number of healthcare providers.

Sweden

Market Potential: 3DWay's Projected Revenues (2020-2024)

3DWAYS MARKET SALES

> In order to proceed with the identification of 3DWays Swedish market sales potential over the already projected five years (2020-2024), it is necessary to include the following **financial assumption** that the company provided to us, namely the **average monthly revenue per printer** in 2019 (400€), 2020 (500€), 2021 (600€), 2022 (700€), 2023 (800€) and 2024 (900€). These numbers will not be put under discussion and, thus, they will be taken for granted. The method applied to determine an approximation for 3DWays potential sales in Sweden will be as it is described below, requiring the **following three steps**: **Identify 3DWays projected revenues in Portugal**; **Identify 3DWays current market share in Portugal**; **Apply the market share established in Portugal to the estimated Swedish market size**.

1 3DWAYS PROJECTED REVENUES

In order to estimate **3DWays projected yearly revenues**, we applied to the current yearly total revenues obtained in 2018, equal to €45,800, the **growth rate that the 3DP industry** applied to the **healthcare sector** has registered in the last three years (21,66%), reflecting the future CAGR of the overall industry. Afterwards, the total amount of projected revenues in every year has been divided for the yearly revenue per printer in 2018, with the aim of obtaining the **expected number of active printers**. However, 3DWays projected yearly revenues based on the CAGR of the overall industry does not entirely reflect the increasing profitability that 3DWays might register in the future, due to the higher price that can be charged as a result of **3DWays increasing bargaining power**. Therefore, the "**adjusted" projected yearly revenues** can be computed by multiplying the number of active printers expected for each year to the yearly revenues per printer settled by the company for each year.

Years	Monthly Revenues per Printer	Yearly Revenues per Printer	Projected Revenues (€)	Expected Active Printers	Projected Revenues Adjusted per Growth in Revenues per Printer (€)	Projected Revenues Adjusted per Growth in Revenues per Printer ($)
2020	€ 500,00	€ 6.000,00	€ 55.721,45	12	€ 69.651,82	$77.313,52
2021	€ 600,00	€ 7.200,00	€ 67.792,15	14	€ 101.688,22	$112.873,93
2022	€ 700,00	€ 8.400,00	€ 82.477,66	17	€ 144.335,91	$160.212,86
2023	€ 800,00	€ 9.600,00	€ 100.344,44	21	€ 200.688,88	$222.764,65
2024	€ 900,00	€ 10.800,00	€ 122.081,61	25	€ 274.683,63	$304.898,83

CAGR revenues in 3DP healthcare (2016-2018)	21,66%
3DWAYS revenues (2018)	€45,800
3DWAYS active printers (2018)	9
Exchange Rate (€-$)	1,11

2 3DWAYS MARKET SHARE IN PORTUGAL

Since it was impossible to retrieve the current market share in the 3DP industry for healthcare referred to Portugal, an **analogy method has been applied by comparing Portugal with Germany**, as previously performed for validating Swedish market size potential. Knowing that the number of hospitals in Portugal was around 200 in 2018, the 3DP market size in Portugal can be computed with the following proportion: $79.19*200/2000 = $7.919 million, accounting approximately for **0.85% on the total 3DP in healthcare market size** ($7.919/935). This percentage has been subsequently applied to the global 3DP in healthcare market size, from 2020 up to 2024, in order to project Portugal 3DP in healthcare market size over the same timeframe. Moreover, it was possible to define **3DWays current and future market share in Portugal** by dividing its projected yearly revenues by the total Portuguese projected market size.

Years	Projected Revenue Adjusted per Growth in Revenues per Printer ($)	3DP in Healthcare (billion $)	3DP in Healthcare (Portugal)	3DWays Market Share (Portugal)
2020	$77.313,52	$1,96	$16.691.571,43	0,46%
2021	$112.873,93	$2,61	$22.175.285,71	0,51%
2022	$160.212,86	$3,31	$28.150.785,71	0,57%
2023	$222.764,65	$4,34	$36.847.500,00	0,60%
2024	$304.898,83	$5,44	$46.254.571,43	0,66%

Number of hospitals (Portugal)	200
Number of hospitals (Germany)	2000
Market Size 3DP in Health Germany in million (2018)	$79,19
Market Size 3DP in Health Portugal in million (2018)	$7,92
Sweden Market Share (2018)	0,85%

3 3DWAYS PROJECTED REVENUES

In order to estimate **3DWays potential sales in Sweden**, it was assumed that the company will have a **similar positioning** in the foreign country due to several similar conditions, which are the following (Index Mundi, 2019):

> Similar **population size** (9,960,487 in Sweden, 10,839,514 in Portugal);
> Similar **healthcare expenditure and composition** (11.9% of GDP and 83% public in Sweden and 9.5% of GDP and 65% public in Portugal);
> Similar **physicians** and **hospital bed density** (4.11 physicians and 2.54 beds/1,000 population in Sweden and 4.43 physicians and 4.43 physicians/1,000 population in Portugal);

Therefore, it was possible to apply **3DWays market share** in Portugal to the market size of AM in Medical and Surgical Equipment and Orthopaedic Appliances in Sweden, obtaining the **company's total projected revenues in the foreign country**.

Years	3DWays Market Share (Portugal)	Market Size for AM in Medical and Surgical Equipment and Orthopaedic Appliances in Sweden (Million)	3DWays Projected Revenues (Sweden)
2020	0,46%	$6,544	$30.311,61
2021	0,51%	$7,239	$36.851,59
2022	0,57%	$8,061	$45.875,68
2023	0,60%	$9,041	$54.660,90
2024	0,66%	$10,230	$67.436,76

Although 3DWays could probably take advantage of the **favourable competitive conditions** in 3DP for healthcare, leading the company to achieve an **equal market share than in Portugal**, the investments that 3DWays should make to penetrate the foreign market would not repay the company in terms of higher profitability since both **market and sales potential remain considerably low,** being able to gain a total number of 5 expected active printers in Sweden every projected year.

Sweden

Entry Conditions: Trading and FDI Overview, Business Registration, IP Protection and Payment Systems

Regarding the entry conditions, the following analysed aspects are those that could increasingly affect 3DWays entry strategy as a result of both its service-based offering and the advanced technological industry in which it operates. By being a member of the European Union, Sweden does not impose any significant tariff barrier while, since 3DWays service takes place online and, thus, remotely, there is no need to investigate neither the national distribution sophistication nor transportation development.

TRADING OVERVIEW

Sweden is the **31st largest export economy** in the world, having a **positive trade balance** of $2.28 billion as a result of Sweden exporting and importing respectively $143B and $141B in 2017. The **top importing regions** are Germany ($27.3B), the Netherlands ($11.9B), Denmark ($9.6B), Norway ($9B) and Belgium-Luxembourg ($7.58B), while an **import value** of **$522 million is** originated by **Portugal** (8.5% of Optical, photo, technical, medical apparatus and 6.6% of Electrical, electronic equipment). Sweden can be considered an open economy as a result of its commitment to **EU and WTO member**, **promotion of free trade** and **low entry barriers** and **no existing discrimination of foreign ownership** (Business Sweden, 2019).

OEC WORLD, 2019

FACTORS TO CONSIDER FOR FDI (ADV. Vs DIS.)

- Favourable political and economic context, creating a **positive business environment** which is also supported by **transparent and reliable judicial system**;
- According to the World Bank, Sweden ranks as **10th country in terms of Ease of Doing Business**, with relatively simple procedures to start, run and grow businesses;
- The economy is well **open and diversified**, with a **strong specialization in high-potential sectors** such as high-tech and sustainable products;
- **Corporate taxes** (at 22%) are among the **lowest in Europe**, applying participation exemption, total tax reduction for interests and no strict capitalisation requirements;
- **High unexploited business opportunities**, displaying highest level of purchasing power in Europe (€46,000 per capita in 2017).

Santander, 2019

- **High labour costs**, with a very strict labour legislation aimed at protecting and prioritizing workers' rights;
- **Currency fluctuations**, affecting the volatility of EU companies profits. In particular, with Sweden not being part of the Eurozone, the currency adopted is the Swedish Krona, which was defined as the worst performing currency in 2019, with a drop of approximately 4% (Liman L., 2019). However, this slump represents a good opportunity for 3DWays to proceed with an FDI, benefiting from the current favourable exchange rates (SEK-EUR).

BUSINESS REGISTRATION

- The **business registration process and its required documentations and/or approvals depend on the type of business that 3DWays will open and run**, based on the entry strategy that will be chosen in the next steps. In particular, there are **three main categories of businesses** among which 3DWays can choose (Verksamt.se, 2019):
- **Sole Trader**: as a sole trader (self-employed), while it is required to register the business with the Swedish Tax Agency, there is no need for registering with the Swedish Companies Registration Office, unless the company wants to apply for IP rights, as in the case of 3DWays.
- **Limited Company**: with the requirement of registering with both Swedish Companies Registration Office and Swedish Tax Agency, a limited company can be initiated by one or more natural or legal entities, having at least SEK 50,000 in share capital.
- **Trading Partnership**: as limited companies, a registration with both Swedish Companies Registration Office and Swedish Tax Agency is demanded, along with an explicit agreement among at least two natural or legal entities.
- In general, there is a **significant positive environment for international companies to establish their operations in Sweden**, as proved by the following statistics (Herodes F., 2019): 50% of Swedish exports are generated by foreign-owned companies, 14,000 foreign-companies are settled in Sweden and 20% of Swedish private workforce is employed by foreign-owned companies. As a result, FDI stock account for 60% of Swedish GDP, while the EU average is approximately 47%.

PAYMENTS MECHANISMS

- The **Swedish automated payment and banking systems are highly advanced**. Based on the common terms of sale, payments occur within **30-90 days after delivery**, with the most common method of international payments represented by **electronic funds/bank transfers**. Other common trade finance methods include documentary collections, letters of credit and payment guarantee. (Export.gov, 2019)
- Due to Sweden different currency, **3DWays will need to decide whether to set the price of its services in the local currency or not**, depending on several factors such as how the company wants to present itself to the new market or how competitors usually set their prices in the industry. This choice will increase or decrease the sensitivity of 3DWays revenues to exchange rates. (Invest Northern Ireland, 2019)

PATENTS APPLICATION

- The **Swedish Patent and Registration Office** (PVR) **is responsible for approving patents in Sweden but it is also an international patent office**. Protection is granted for a maximum period of 20 years, while for **medical patents might be possible to apply for 5 additional years**. In the PVR'S Swedish Patent Database e-service, 3DWays can easily research for Swedish patents, public patent applications and EP that have been validated in Sweden.
- **Example of costs**: Buying a novelty search from PRV: 12,100 SEK; Agent costs for writing a patent application, including administrative costs: 90,000-120,000 SEK; Filing and granting fees in Sweden: 5,500 SEK; Annual Fees in Sweden over 10 years: 20,100 SEK (Verksamt.se, 2019).

Sweden

Entry Conditions: Regulations on Trading Services, Cloud-Computing Services and Medical Devices

TRADING IN SERVICES

> Since trading in software can be classified as **trading in services**, it becomes necessary to assess the overall regulation affecting cross-borders transactions related to this segment. With Sweden ranking 18th for trade across borders and Services Trade Restrictions Index overall score being 15.50 (WTS, 2019), exporting services to Sweden follows the **same regulations applied in EU**, so that there is no need to file custom declarations or pay custom duties or tariffs. Services as goods can be **traded freely** and Sweden, as any other European country, **cannot set any additional requirements** to prevent a company with a home-country license to trade. The only tax applied is the **VAT**, which is set at **25% for the majority of the imported goods and services.** However, since 3DWays is a B2B business and the purchaser will be a VAT-registered purchaser, the company will not charge any VAT selling a product to another EU country such as Sweden, since is the purchaser that has to report the VAT in its own country.

> While there are only **few common EU rules** for specific service industries (military and defence), around **70% of the private** services sector is regulated by ***EU Services Directive***, implemented through the "Genomförande av tjänstedirektivet" in Sweden in 2009. In order to sell a service, **certifications after testing and controlling procedures** of a service/process are necessary.

> In Sweden, the **national point of single contact for services**, where information about requirements and licences applied in a specific country can be found, is ***Verksamt.se***, on which it is possible to make **electronic applications** for the **licences** required to sell services in Sweden.

DIGITAL BUISNESSES & CLOUD COMPUTING

> 3DWAYS can be categorized as a **digital business** since it is a service provider at a distance via electronic means, mainly consisting in its **cloud-based software**. The regulation governing **could computing services** has two main objectives: **data security** and **data privacy** (Ram R. J., 2017). In fact, cloud computing services imply a significant **data flow** through which information are transferred across national borders. By being technology neutral, **Swedish legislations lack of any direct and specific regulation regarding cloud computing**.

> The majority of legislation indirectly affecting the industry originates from the EU, including the following acts: ***Contracts Act*** (1915:218); ***Electronic Commerce and other Information Society Services Act*** (2002:562); ***Electronic Communications Act*** (2003:389); ***Distance*** and ***Off-Premises Contracts*** Act (2005:59); ***Marketing Act*** (2008:486); ***EU General Data Protection Regulation*** (2016/679).

> According to the transposition of ***EU NIS Directive*** in Swedish law on 1 August 2018, operators of essential services, as health and medical care, within the digital infrastructure industry are required to establish "**appropriate and proportionate technical and organisational measure**" in order to "manage risks and prevent and minimise the impact of incidents". Although it refers to the case of 3DWays for type of service and sector served, small and micro businesses (< 50 employees and turnover < 10 million) are excluded. (IT Governance, 2019)

MEDICAL DEVICES

> Medical devices produced by 3DP technologies can have a variety of applications (orthopaedic/cranial implants, surgical tools, dental restorations and external prosthetics). Although **EU legislation** does **not directly** include **guidelines** for AM applications within healthcare, as in the case of U.S. Food and Drug Administration (FDA) legislative specifications, **3DP technologies** for **medical devices** in **Europe** are regulated by the new ***European Medical Devices Regulation*** (MDR), adopted in 2017 in order to substitute the European Medical Devices Directive (MDD) and the Active Implantable Medical Devices Directive (AIMMD), together with the ***Invitro Diagnostic Medical Devices Directive***. According to the assigned class of risk, medical devices within the EU are subject to **conformity assessments**, evaluating their safety and performance, which can be more or less strict. For example, medical devices belonging to most risky class (III), including implantable devices such as 3DP organs, tissues or bones, require "**independent design dossier review**" (third party assessment). Once passed the conformity assessment, manufacturers can apply a CE (Conformité Européenne) mark on their medical device.

> In Sweden, the responsible authority is the **Medical Products Agency** (**Läkemedelsverket**), which published the following **guidelines** in order to define **whether or not a software can be considered as a medical device:** the software needs to have the functionality supporting its intended use, the product risk assessment needs to include patient safety, the manufacturer needs to demonstrate that product performance satisfies a specific medical purpose and, finally, the manufacturer needs to obtain a CE marking for the software. (Eisenhart S., 2012)

CONCLUSION – IN DEPTH

1 CONTACTS

Although 3DWays does not have any direct contact in Sweden yet, the country offers a large range of research and innovation institutes, as well as entrepreneurial advisors, with which the company can potentially establish a collaboration in view of its international expansion in the country. However, a limited number of them actually provides a type of program or support specialised to the AM industry, thus potentially limiting the interest of these organizations in establishing a strategic partnership with 3DWays. Moreover, the difficulty for international market players to be selected for innovative-based collaborations in Sweden represents another significant disadvantage.

2 COMPETITION

With a not-fully developed AM industry, the competition appears relatively low, especially referred to the healthcare industry. In fact, there are very few players with a value proposition explicitly oriented towards healthcare providers. In this sense, 3DWays can highly benefit from a low-intense competitive rivalry and, thus, from a first-mover advantage. On the contrary, the Swedish market might not be mature enough for a highly innovative service such as 3DWays remote control management, which implies an already advanced AM industry, with high adoption rates.

3 MARKET POTENTIAL

Swedish market size for AM applied to healthcare appears to be extremely small compared to other European countries such as UK and Netherlands, affecting negatively 3DWays potential sales in the foreign market. In fact, Swedish AM for healthcare does not seem to grow as fast as the global trends. This is a crucial constraint for 3DWays, which aims at maximising its profits in order to increase its enterprise value in view of its potential sell-out. With such a short-term perspective, 3DWays could not be able to achieve the goals settled for the upcoming years, with Portugal providing higher growth opportunities.

4 ENTRY CONDITION

By being in line with the other European countries, Sweden does not seem to distinguish itself for (s)favourable trade conditions. In fact, the legislative framework influencing the type of service and industry, in which 3DWays is operating, is settled upon EU directives. For this reason, there is not any particular advantageous entry condition from which 3DWays could benefit once decided to expand its business to Sweden.

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